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## Labour Government and the Foundry Industry

There has been some apprehension amongst certain groups of manufacturers of castings that the new Government might decide to nationalise the foundry industry. Sir Stafford Cripps has made it abundantly clear during his talks with the representatives of the textile industries that so long as the units comprising that industry are properly equipped with the latest types of machinery and afford good working conditions to the operatives, the owners will be allowed to paddle their own canoe. Apparently, the Government favour amalgamations, but have not expressed their policy towards employers' federations. These are so diverse in character and objective that it would be difficult to legislate before undertaking a thorough examination of the whole situation. From an inside knowledge of most of those connected with our industry, we can state categorically that no attempt is being made to exploit the public through combined action. A most important work of the average enlightened employers' federation is the effort they make through their support of co-operative research work and their technical committees to keep up to date—and this policy is favoured by the Government. Working conditions in the future will not be governed solely by the size of the weekly pay envelope, but take cognisance of cleanliness, heating, lighting and ventilation, plus the provision of proper social amenities such as modern sanitation and efficient canteens. It must be obvious to all observant persons that the large majority of the young men and women now ready for leaving the Services take a real personal pride in their appearance. They will not take kindly to the dirtier industrial occupations unless they are assured of conditions which will enable them to leave the factory in that spick and span state that they acquire when they now come home on leave.

There is sure to be a tightening up of factory regulations, and it seems to us essential that the employers' federations should be strengthened to the utmost in order that the Government should be in possession at the earliest possible moment of well considered opinion as to what the practical outcome of any proposed legislation will be. This is essential, not only for the well being of the industry, but for the very wide interests it serves. The war has furnished numerous examples of the necessity for co-operative action by the industry and the indications are that in a rapidly changing world this state of affairs will continue. The conditions within the industry are so diverse that no charge of monopoly control can ever be brought against it as a whole, whilst its elasticity will always be an effective brake on any attempt made by a section to exploit the public. There is at the moment every reason why the foundry industry should re-equip itself with the latest machinery because of the two factors of huge demands and the shortage of labour.

The notion that mechanisation will knock the bottom out of any boom must not enter into the picture. We are well aware of the enormous amount of work to be done in this industry, but are unable to visualise what the rest of the world needs. A slight appreciation of the problem can be gauged from the statement that if 1,000 tons of rubble were cleared away from Essen daily, the complete clearance would take 30 years—and Berlin is worse! Thus our greatest competitor for the world's markets has enough to do at home to prevent her being formidable for many years. Her steel output is to be controlled at 10 million tons per year, whilst ours is to be correspondingly stepped up. Old-fashioned people always asserted that if building and agriculture were prosperous, the trade of the country would be good. There is every reason to bank on these two factors for a prolonged period.

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## BOOK REVIEW

**Collected Papers on Metallurgical Analysis by the Spectrograph.** Edited by D. M. Smith and published by the British Non-Ferrous Metals Research Association, Euston Street, London, N.W.1. (Price 21s.)

For some years past the B.N.F.M.R.A. sub-committee on metallurgical applications of the spectrograph has operated through various panels covering different aspects of the work. Apart from guiding the association's own spectrographic researches, the individual members of the panels have also provided results obtained in their own laboratories. In this way a considerable number of reports have been distributed to the B.N.F.M.R.A. membership, some emanating from the association's own research staff and some from laboratories of member companies.

The present volume contains a selection of 13 Papers based on these various reports: two on the processing and calibration of the photographic plate; four on analysis of aluminium and aluminium alloys; three on lead and lead alloys; one on zinc alloys; two on copper alloys; and one on platinum. The co-operative nature of this work is shown by the fact that of these 13 Papers, six are from members of the association's staff, three from member companies, one from a Government department and three are reports from panels of the B.N.F.M.R.A. sub-committee.

The book is not a systematic treatise on the spectrographic analysis of metals and alloys, but many of the Papers make practical recommendations on various aspects of technique. The Papers cover a wide range and the book will be of great interest to all engaged in the spectrographic analysis of non-ferrous metals.

## UNITED NATIONS PROPERTIES IN GERMANY

The interests of United Nations owners of property in Germany are being safeguarded by a special department (Property Control Branch) of the Control Commission. As far as British owners are concerned, all communications should be addressed to the Trading with the Enemy Department, 24, Kingsway, London, W.C.2. Owners of property in Germany should already have made a return in regard to such property to this department.

As information becomes available, individual owners will be notified in regard to the condition of their property; but at present no inquiries by interested parties as to the state of specific properties in Germany can be dealt with by the Trading with the Enemy Department. It is inevitable in the circumstances prevailing in Germany that information will be available to some owners before others, and those who receive no news as to their property can rest assured that their interests are being guarded as far as practicable by specialist officers of the Control Commission, and that information will be forwarded to them as soon as possible.

## IRONFOUNDING SIDELINES

Shortly after the outbreak of war, the Director of Iron Castings had for a period to be a sort of dictator as to whether castings could be used for unwarlike purposes. One of his first problems was a claim for more than a thousand tons of iron castings for coffin handles. Although these decorative attachments appear to be of gold or silver, in truth they are but grey iron carrying a brilliant finish. The Director felt a little uneasy about the interment of so much useful metal and deemed that a proper inquiry was called for. He asked for a small delegation to call on him and thought to arm himself by practical observation. He therefore, in the interests of mechanical warfare, attended the first funeral he could find and noticed that the coffin handles apparently served no useful purpose. However, when the black-coated delegation arrived armed with numerous samples of these fittings, the Director soon learnt that a little knowledge was dangerous, for apparently the custom of the trade varies in different districts, and in some places the handles are used! There remained only for the Director to suggest the general use of the lightest type.

Next there was the case of bird cages. The Director was nonplussed when he received a request for 20 tons of castings. However, the manufacturer of bird cages would not accept the Director's assertion that they were merely an assembly of thin sheet steel, wire, and glass, and cited the South American market, where the trade demanded the provision of imposing pedestals! Shortly afterwards, the Control took on a different type of work, and this sort of business was relegated to the Board of Trade.

## "REVUE DE METALLURGIE"—1940

After the fall of France, in June, 1940, "Revue de Métallurgie" appeared only bi-monthly owing to the stringency of the paper restrictions. We have recently received five copies covering the period May to December. They contain the following articles of direct interest to the foundry: "The Re-use of Industrial Scrap and Residues, I—Italy," by L. Descroix. This gives an account of a congress called together in Turin specially to consider the reduction of industrial waste. It appeared in No. 5 of 1940. The article is carried through to cover American developments in numbers 7 and 8. The former also has a study on "Grain-size in Light and Very Light Aluminium-magnesium Alloys," by Dr. Paul Bastien. The latter includes an article by Mr. P. A. Jacquet on "Electrolitic Polishing of Metals, Present State of the Technique and its Applications." There are the usual abstracts from foreign literature, a minimum of which has been drawn from foreign sources.

AN ANNOUNCEMENT from the Ministry of Labour and National Service details a number of schemes now operating for training of ex-Service men and women for participation in a number of trades. Moreover, it lists a further 16 schemes which are in preparation. No trade in connection with the foundry industry is included.

# SOME PRODUCTION CONTROL PRINCIPLES AND THEIR APPLICATION TO THE MANUFACTURE OF STEEL CASTINGS*

*A method of control is disclosed, which efficiently co-ordinates the commercial and manufacturing activities of a steel foundry*

By A. B. LLOYD, B.A. (Cantab.)

Before plunging into the technicalities involved in the application of a production loading system to manufacturing operations, it is desirable to consider why it is necessary for such systems to be an essential part of almost any up-to-date manufacturing organisation.

Looked at from the accountant's point of view, the production control department is an overhead expense, since the department consists entirely of non-producers. The first question to answer therefore is, "It does not produce anything; why have it?" Broadly speaking, the answer is that in a large and complex manufacturing unit, it is impossible to manufacture the saleable products efficiently without some means of ensuring that the work goes through the manufacturing processes fully in accordance with a preconceived plan. By "manufactured efficiently" is meant that the saleable products must be manufactured strictly to specification without waste of labour or material, and must be delivered to time. In view of the large variety of parts which have to be processed, and the number of operations which have to be performed on each article manufactured, and in the assembly of the finished product, the execution of a plan cannot be achieved without the creation of written schedules of work, and written records of what has been done.

Further than this, most executives have probably found, when first installing a production loading system run by a specialised department, that unless the production control department, which runs the production loading system, has the authority to insist on the schedules they prepare being met, there is a danger of the production control department becoming a unit which is concerned with the production of paper work as an end in itself.

## General Principles

It is therefore proposed to devote the first part of the Paper to stating the basic conditions which are necessary in the organisation of the works in order that production control may be successfully applied, and lead on to a description of the principles and how they have been applied to facilitate the manufacture of steel castings.

The success, or otherwise, of any scheme depends on sound organisation, which gives the managing director, in charge of a business, effective control of it, combined with active co-operation and consultation between specialist departmental heads, works managers, foremen, and planning engineers. Elaborate schemes of paper work planning are of little avail if the control of manufacture is loose, and if there is a lack of

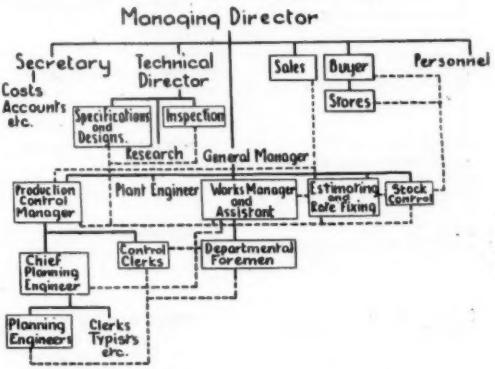


FIG. 1.—ORGANISATION CHART.

appreciation of each other's functions between personnel of the manufacturing and production control departments.

Fig. 1 shows an organisation chart which could apply to a general engineering concern, employing between 1,000 and 3,000 people. The chart is intended to bring out the significance of the various functions which have to be taken care of, and shows a typical way in which these functions may be controlled.

The main object of putting on paper an organisation chart, showing how the responsibility of the managing director of a business is exercised through his subordinates, is to ensure (*a*) that the load of work involved in directing the business is evenly distributed between the executives, and (*b*) to ensure that each executive has a clear appreciation of where his responsibilities begin and end. Incidental to these objects is the proviso that each executive must be given responsibilities for which his qualifications and experience fit

* Published by permission of the Institute of Production Engineers. The Paper was presented to the Lincoln section of the East Midlands branch of the Institute of British Foundrymen.

## Some Production Control Principles

him. If one is given the task of setting out an organisation chart for a particular business, it is best, in the first instance, to take no consideration of the personalities of existing executives, but to set out functions which have to be taken care of, such as manufacturing, personnel, production control, accounting,

**BASIS OF FUNCTIONAL CONTROL**

| PRODUCTIVE AGENT | RESPONSIBLE FUNCTIONAL AUTHORITY |
|---|---|
| FIXED PLANT. | PLANT ENGINEERING DEPARTMENT |
| LOOSE PLANT. VIZ. PATTERN TACKLE, JIGS, TOOLS, GAUGES ETC. | METHODS OR JIG AND TOOL DESIGN DEPARTMENT |
| MATERIAL RAW OR PROCESSED | STOCK CONTROL |
| PLANNING. SCHEDULES AND ALLOCATION OF WORK | PRODUCTION CONTROL |
| LABOUR EMPLOYMENT WELFARE, AND TRAINING ETC | PERSONNEL MANAGEMENT |
| SUPERVISION EXECUTION OF PLANS | WORKS MANAGEMENT |

FIG. 2.—BASIS OF FUNCTIONAL CONTROL.

etc., and draw them out in such a way as to ensure that no individual executive is responsible for the activities of more than six subordinates.

Fig. 1 shows an attempt to apply this principle to a typical imaginary engineering concern, and it may be presumed that, in applying this organisation to a particular concern, some amendment would be necessary to take account of the personalities and experience of the executives.

Starting at the top of the chart, it will be noted that reporting direct to the managing director are the secretarial departments, personnel, sales, buying, research, design and development, the three latter being controlled by a technical director or chief engineer. It is not intended to go into the relationship between production control and the accounting and personnel side, although it should be remembered that production control, like every other activity in a business, has its financial implication. The control is, however, particularly concerned with the technical departments and the sales and buying departments, since, as will be seen later, these departments are responsible for providing the basic information which is necessary to enable the production control department to plan effectively, and for co-operating with the production control department in getting out designs, supplying material, etc., to enable production to take place in accordance with the plan.

Also reporting to the managing director is a general manager, who is responsible for manufacture in the broadest sense. He is assisted by a works manager, to whom the foremen of the manufacturing departments report, and who is directly responsible for the effective execution of production requirements. Assisting the general manager are the production control manager, with whom the system is chiefly concerned; the plant engineer, responsible for maintenance; the standards, or estimating and rate-fixing departments, responsible for rate-fixing and production times; and a stock control department responsible for ensuring

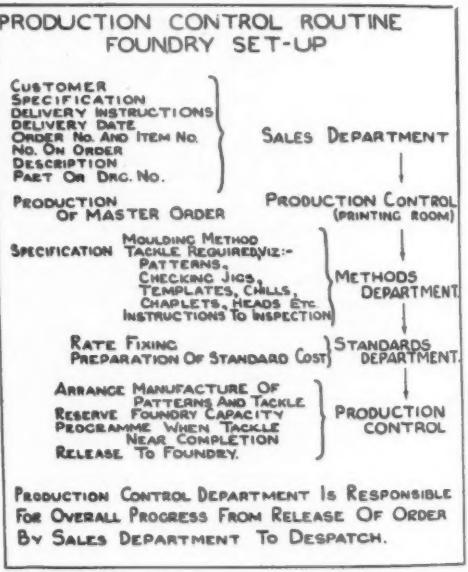


FIG. 3.—CONTROL AS APPLIED TO A STEEL FOUNDRY.

that stocks are controlled in accordance with the policy of the management, and that material is available to meet production requirements.

Dealing with the internal organisation of the production control department, this is set up as follows:—The production control manager has control clerks in the works, operating alongside each departmental

foreman, and he is assisted by a planning engineer, who is responsible for preparing production programmes for each manufacturing department. Thus, in each department, the smooth flow of production depends, to a large extent, on the co-operation of three individuals, namely, the foreman of the department, the control clerk, and the planning engineer, wtih planning clerks working from the production control department.

### Basis of Functional Control

It is now desirable to look at the problem from another angle (see Fig. 2), and examine various agencies, the co-ordination of which is necessary in order to ensure effective production. The productive agents are: fixed plant; loose plant, such as pattern tackle, jigs, tools, gauges, etc.; material, either raw or processed; planning, involving programmes, schedules, and allocation of materials; labour, the men who actually do the job with the facilities and material

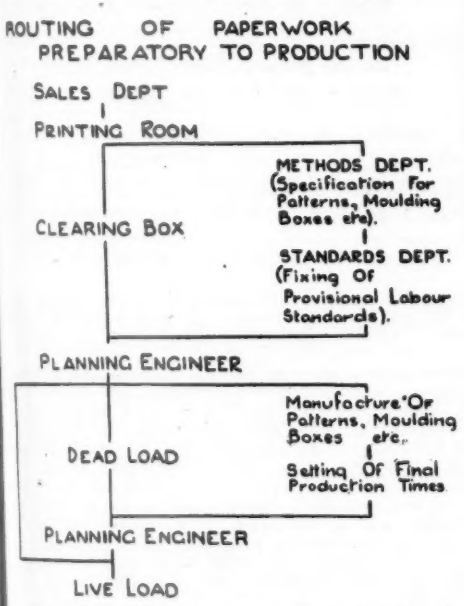


FIG. 4.—PRELIMINARY WORK PREPARATORY TO PRODUCTION.

provided; and supervision, represented by the foreman or supervisor who directly controls production. The following departmental heads are responsible for seeing that these productive agents do the work required of them.

*Fixed plant* is the responsibility of the plant engineering department, reporting to the general manager. With the activities of this department we are not concerned in this Paper, but, in connection with fixed plant, a word must be said regarding the problem of capacity, since, unless the capacity of fixed plant to produce is known, accurate planning is impossible. For the purpose of this Paper, capacity will be considered in two senses: (1) Full capacity, as the output which can be obtained from the plant under ideal operating conditions, allowing the plant to operate continually day and night, but allowing adequate time for routine maintenance, and (2) operational capacity, this being the output of the plant, assuming the normal

SUMMARY OF DEFINITIONS RELATING TO CAPACITY.

| | |
|---|---|
| NORMAL HOURS. = | Man hours necessary to complete a given task assuming uninterrupted effort and no interference. |
| STANDARD HOURS = | Normal hours + allowable relaxation. |
| ALLOWED HOURS = | Standard hours + allowance for interference due to shop conditions. |
| REGULATED HOURS = | Working hours of shop. |
| OPERATIONAL CAPACITY. = | (Working hours of shop x number of producers) + expected hours saved. |

FIG. 5.—DEFINITIONS RELATING TO CAPACITY.

time for routine maintenance, normal interference with production, and specifying the number of hours during the week which the management considers it desirable for the plant to run.

*Loose plant* is a term devised to cover anything required, of a portable nature, for the production of the job, which is not ultimately a component of the finished machine. This definition covers pattern tackle in the case of a foundry; jigs, tools, and gauges in an engineering works. The design of such tackle is the responsibility of a methods or jig and tool design department, operating under the technical director or chief engineer. The production of patterns, jigs and tools is a works function, and the planning of their manufacture is the responsibility of the production control department in the same way as is the production of the goods which are finally sold to the firm's customers.

*Material* is the responsibility of a stock controller. In some engineering works a large variety of parts have to be purchased, and a number of operations have to be performed upon them before they are finally assembled in a finished machine. In order that the purchasing, storing, and manufacture of these parts may be effectively co-ordinated, a stock control department is set up. In the case of the foundry trade,

## Some Production Control Principles

by far the largest stock value is tied up in raw materials, and there is very little material which has to be stored between manufacturing operations. It is, therefore, the normal practice to put the control of stock in the buyer's hands.

*Planning* is the responsibility of the production control department, and with that we shall be dealing in detail.

*Labour*, which has its problems the same as machinery, is the responsibility of the personnel manager. This subject, again, is not covered by this Paper.

*Supervision*, which involves the execution of the plan after all other functions have been taken care of, is the responsibility of the works manager.

### Application to Manufacture of Steel Castings

The various functions, whose effective co-ordination contributes to efficient production, have been dealt with, and it will be seen that we gather from them basic information, without which effective planning is impossible. At this stage it is proposed to revert from the general to the particular, and attention will be confined to the application of production control to steel foundry operations. It will be seen that the principles outlined above apply. Fig. 3 summarises the means used for collecting information required in order to build up a programme of work. Sales department provides the following information:—Customer; specification, which incorporates the metal in which the castings are to be made, together with particulars of the tests to which they have to be submitted; delivery instructions and delivery date; works order number and item number; number of castings on the order; description of the castings; and part or drawing numbers. All this information is incorporated on an Ormig master order, and is sent to the printing room in the production control department, where all forms necessary to plan, progress and record production of the job are run off. These incorporate foundry order sheets, despatch order sheets, job cards, planning cards, and a variety of other forms.

This information then goes to the methods department, which reviews the job and decides the way in which it is to be manufactured. This department has to ask itself two questions:—(1) How is the job to be made? (2) What will the works require in order to make it? First, how is the job to be made? The moulding method must be specified, that is, whether the job is to be made on a moulding machine, and, if so, what type of moulding machine is most suitable for making it. They must specify the type of moulding box that will be required, and any special fettling procedure. Secondly, what will the works require in order to make it? The standard moulding boxes and equipment available in the foundry will be reviewed, and all the necessary procedure will be set in motion for ordering pattern tackle, jigs, templates, and any other material which is peculiar to the job and not standard equipment in possession of the foundry.

Methods department then passes the job on, after completing its investigation, to standards department, where all the information is translated into production operations and times. Standards department have formulæ which enable them to determine the direct time involved in every operation required in the production of the castings, and these times are used as a basis for wage payment. It will be appreciated that considerable consultation is necessary between methods and standards departments so as to be certain that the

M/c Moulding Programme For Monday 1-11-1943 Day Shift Week No. C32

| M/c | Time Start | Time Finish | Order & No. and Item | Description | Box Size | Planned Boxes per Shift | No. of Boxes Planned | No. of Castings Planned | Total Castings Planned to Date | Metal Code |
|---|---|---|---|---|---|---|---|---|---|---|
| 'P' | 8-0 a.m. | 8-50 a.m. | 23879-1 | Fork Cstgs & 1 Test Piece | 20x20x9/9 | 35 | 30 | 30 | 452 | MBT |
| | 8-50 a.m. | 9-15 a.m. | 24072-1 | Fork Cstgs & 1 Test Piece | 20x20x9/9 | 35 | 15 | 15 | 5020 | MBT |
| | 9-15 a.m. | 11-15 a.m. | 24326-2 | Clutch Cts. | 25x16x6/8 | 42 | 84 | 168 | 1076 | H |
| | 11-15 a.m. | 12-35 p.m. | 24347-2 | Side Cutters | 20x16x9/6 | 41 | 54 | 108 | 432 | R |
| | 12-35 p.m. | 2-50 p.m. | 24072-1 | Fork Cstgs & 1 Test Piece | 20x20x9/9 | 35 | 45 | 45 | 5065 | MBT |
| | 2-50 p.m. | 5-30 p.m. | 23515-1 | Track Links | 25x18x6/6 | 26 | 70 | 140 | 4842 | L |
| 'A' | 8-0 a.m. | 9-30 a.m. | 24069-1 | 'A' Mach's Track Links | 30x20x6/6 | 13 | 24 | 48 | 942 | L |
| | 9-30 a.m. | 11-50 a.m. | 24878-8 | Swing & Prop Gears | 25x24x8/8 | 17 | 34 | 34 | 121 | L |
| | 11-30 a.m. | 2-40 p.m. | 24069-1 | Track Links | 30x20x6/8 | 13 | 24 | 48 | 990 | L |
| | 2-40 p.m. | 3-35 p.m. | 24878-8 | Swing & Prop Gears | 25x24x8/8 | 17 | 9 | 9 | 130 | L |

FIG. 6.—MOULDING MACHINE PROGRAMME.

| | | | |
|---|---|---|---|
| CUSTOMER: ABC Engineering Co. | | These Order No.: B 512 | Our Order No.: 61245 |
| | | No. of Items in Order: 4 | Date of Order: 5-11-43 |
| DELIVERY INSTRUCTIONS: To their 'A' Stores, Queen's Road, Birmingham. | | | |
| GENERAL INSTRUCTIONS: Pattern to be altered to revised drg. C817 | | | |
| DELIVERY DATE: 100 sets per week Commencing 1st Dec 1943 | | | |

| Item | No. Off | T.P. | Description | Patt. Instr. & Tackle | Drg. No. | Metal Grade & Wt. Lbs |
|---|---|---|---|---|---|---|
| 3 2 Foundry | 2000 | 3H | Rollers | P.423 Patt No. | C817 | M 24 |

| Moulding Plan | Patts per Flask | Section & Box Size Mould | Codes | Previously Planned | Previously Moulded Actual | To Mould This Week Planned | This Week Actual | Moulds Unit | Moulds Total | Codes Unit | Codes Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| M28 | 2 | 26x26 | 3 | 1100 | 956 | 100 | 120 | 40 | 48 | 18 | 22 |

FIG. 7.—PLANNING CARD.

methods adopted are such as will ensure economical production.

The job is then passed back to the chief planning engineer, working in production control department, who, having collected all his basic information, is responsible for planning the manufacture of the job. In the first place, patterns have to be made. In order to meet the delivery date, the patterns have to be in

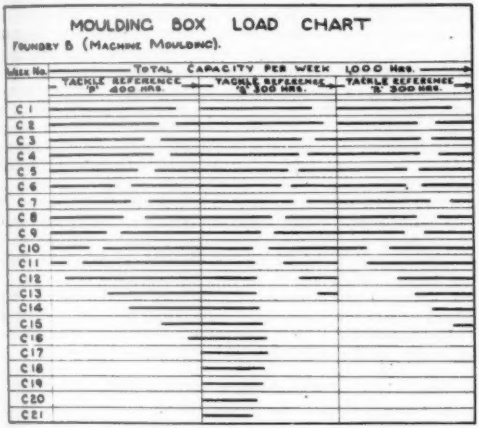


FIG. 8.—MOULDING BOX LOAD CHART.

the foundry by a certain time. Capacity must, therefore, be reserved in the foundry at a time when the patterns can be ready for production.

### Routing Preparatory to Production

Fig. 4 should give a good picture of the preliminary work required before manufacture starts. As the papers are released from the printing room, the relevant forms are sent to methods and standards departments, the remainder of the papers being kept in a clearing box. When the forms return from standards department, duly filled in, they are reviewed by the planning engineer, who reserves capacity in what is termed "dead" load, while patterns, and any other tackle required, are being manufactured. The term "dead" indicates that, due to patterns not being available, the job cannot be put on the foundry load for production. Upon completion of the patternwork, the planning engineer reviews the job again, puts it on a programme, and so makes up his "live" load.

### Method of Planning

The production control manager is responsible both for keeping the manufacturing departments supplied with work and for keeping sales department and the higher management informed regarding how the manufacturing departments are loaded to assist them in forming the sales policy. He uses his load charts to assist him in fulfilling this responsibility. Examining the task which confronts the production control department in making up a programme of work which can be executed by a given date in a department which, for instance, has working in it three different types of moulding machines, it will be seen it must produce a programme of work which will keep each group of moulding machines occupied for a full week, and must be satisfied that it is possible for patterns and cores to be available for feeding the machines. The department must also satisfy itself that the necessary amount of metal, of the correct specification, can be made available by the furnaces to ensure that the moulds produced can be cast. In order that it may carry out this task effectively, it is necessary that the capacity of the core shop for producing cores, the capacity of the moulding machines for turning out moulds, and the capacity of the furnace, serving these machines, for producing metal, is known.

An attempt was made, earlier in this Paper, to define the capacity of fixed plant, and it will be recalled that furnaces and moulding machines are fixed plant, within the terms of our definition. In defining the task set (see Fig. 5), the production control department, it will be noted that already the Author has used the

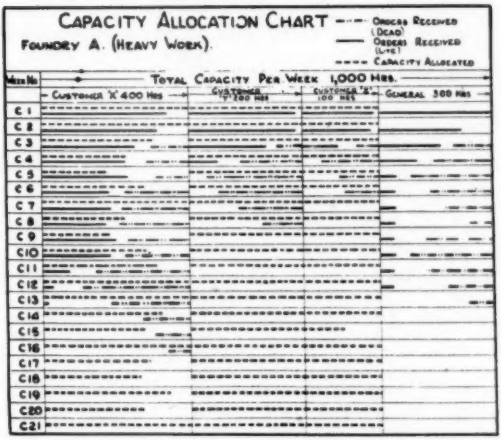


FIG. 9.—CAPACITY ALLOCATION CHART.

word "capacity," and in this connection he is referring to what was defined as "operational capacity" of the plant being loaded with work.

More must be said, before going further, regarding the accurate determination of "operational capacity." It may be measured in any suitable units, according to the nature of the work being carried out. The most convenient unit for foundry operations is found to be the *allowed hour*, this being the quantity of work it is

## Some Production Control Principles

considered a man should be able to execute in one hour, working at a normal rate of effort with reasonable relaxation allowed. The determination of the volume of work which can be obtained from a piece of plant, such as a moulding machine, in a given time, is something which cannot be done accurately without the use of time study, and since the accurate assessment of allowed hours is so vital in ensuring that one determines accurately the capacity of the plant, a digression into the field of time study seems, at this stage, to be necessary.

Let it be imagined that a time study is being taken on a man making a mould on a moulding machine. The normal practice is to break down the operations he performs, in fulfilling his task, into a number of components. When the time study is worked up, a distinction is made between time spent on operations which were a necessary part of the complete task, time spent on work which could have been eliminated by more forethought on the part of either the man, the foreman, or the management, and time when the man is not proceeding with the job at all. A summary of the elements of the job which contributed to its successful completion, ignoring entirely time spent in relaxation or incidental work, is called *normal time*. Normal time, plus allowances for relaxation, which is necessary to enable the man to maintain his effort throughout the day, is called *standard time*. Standard time, plus allowances for incidental work which the man has to do which could be eliminated by better organisation, is called *allowed time*. It is the allowed time which is used as the basis of measurement of the operational capacity. Having obtained from time study the measure of work, there is now to decide, bearing in mind plant conditions, availability of man-power, and load, what shifts need to be worked.

In the works with which the Author is associated, it is the normal practice to post in each department, for each week, what are termed *regulated hours* for each group of men in the department, this being the hours that the group of men are called upon to work each day throughout the week. These regulated hours are based very largely on the loading requirements notified to the works manager by the production control department, and form the basis of the operational capacity used by production control department for planning. Allowed hours are set so that a man of average ability may earn between 25 and 50 per cent. saving on the allowed hours issued to him. A full week's work, therefore, for a moulding machine in any one department will consist of a plan which will add up to allowed hours amounting to 50 per cent. in excess of the regulated hours for the man operating the machine, multiplied by the number of operators.

Assuming, therefore, that the production cycle in the department flows smoothly without interruption, capacity for the needs of the coreshop and moulding machines can be measured in allowed hours required to turn out the work which will be produced by moulding machines working to operational capacity. In actual practice, a measure of interference must be expected, and it is usual to issue to the foundry a programme amounting to about 80 per cent. of its operational capacity, having available further work which can be put in to fill the gap if the foundry looks like fulfilling the programme ahead of time. This is contrary to the view of some authorities on production control, who maintain that a programme should be issued consisting of at least 100 per cent. of the operational capacity of the department. This may be satisfactory in production units manufacturing largely for stock, but it definitely breaks down in steelfoundry work, where the foundryman is nearly always manufacturing to a customer's order against short-term requirements. Issuing a plan to a department, which is more than the department can accomplish in the week, means that the uncompleted work has to be replanned, either for the following or subsequent weeks, with the result that a clean start at the beginning of a week is never obtained. Urgent needs are apt to crop up in the middle of a week, and by planning short of capacity, these needs can be accommodated. If no such needs reveal themselves, it is always possible to draw on future plans to make up the week's work. It is the definite experience of the Author that it is very much easier to make work ahead of plan than, having fallen down on a plan, to interfere with later schedules in order to accommodate the unexecuted work.

### Working to a Programme

Fig. 6 illustrates the information which is given to the foundry department for a machine moulding programme, and in the case of machine moulding, the management is able not only to specify that the job is to be done in a particular week, but to lay down a time-table of work for each day of operation. The programme therefore comprises the following information:—Machine number; the time of the start and finish of the run off each pattern; the particulars identifying the job, comprising order and item numbers, the number of moulding boxes required per hour to meet the plan, description, the size of the moulding boxes required, the number of boxes required to complete the castings called for from the pattern, the number of castings planned, which will be different from the number of boxes if there is more than one casting per mould, and the total number of castings planned on that order. This is for the information of the foundry control clerk. The metal code is also incorporated for the information of the foundry foreman when casting the moulds.

It should be noted that this programme is built up so as to ensure that the machines are loaded up to the number of hours which has been agreed will provide a working load for the week, at the same time making provision to ensure that no box size is overloaded, that metal is available to meet the plan, and that the coreshop has capacity to produce the necessary cores.

### Planning Cards

Turning now to the planning cards, illustrated in Fig. 7, which provides the basic information from

which the programme just referred to are built up, and from which are prepared the load charts which are used to enable reliable delivery information to be given to the sales department. For every item on every order which comes in, a planning card is produced. This comprises all the basic information prepared by the sales department, and the following information which is either entered by the planning engineer himself or collected from the information supplied by the standards and methods departments. Taking a machine moulded job again, the moulding plan week is entered, this being the week in which the job must be produced in the foundry in order to meet the commitment undertaken to the customer. The number of patterns per plate indicates the number of castings which will be produced per mould from one machine operation. The next column gives the size of box and type of machine on which the job has to be moulded, and also the number of cores on the job. The next column gives the previous history regarding the number of moulds made to date. The next column gives the number of moulds to be planned for this week, and the last two columns give the number of moulding hours and core-making hours to which this batch refers.

There is one planning card to every item on every order, and further than this, there is one planning card for each week's production off each item. The cards, therefore, for the various items which are planned to be produced on a group of machines in a single week are filed together. In the right-hand column on the card, as has been said, are particulars of the moulding hours involved. If these are added up on all the cards for any one week, we can see at a glance how many hours of work we have planned on the group of machines for the current week. These can be transcribed on to the load chart, and on the load chart we can readily see what percentage of capacity the jobs which have been planned fills.

### Load Charts

The load chart summarises the information on the planning cards, and a typical load chart is shown in Fig. 8. It will be noted that on the load chart shown two distinct lines are indicated for a group of machines, starting from each side of the chart, and not quite meeting in the middle. The lines running from the left-hand side of the chart indicate the total number of hours planned for which patterns and all auxiliary tackle are available for foundry production. Running from the right-hand side of the chart is another line, which is termed the "dead" load. Jobs in the "dead" load are those which are planned for production during a given week, but as the week may be a little way in the future, work has still to be done on the patterns, and the job is still not available for production. A gap between these two lines indicates the capacity available for planning further work. These charts can be kept in pencil, the "live" load line being extended, and the "dead" load line being erased as patternwork is completed on the various jobs. By a moderate amount of capital expenditure, the job can be dealt with more scientifically, and equipment can be provided whereby strips of cardboard can be inserted to represent either "live" or "dead" loads.

### Capacity Allocation

Another type of problem comes up in connection with load charts. Sales department may know of work which they can definitely count on booking, but for which they have not yet received firm orders. In these cases, specific reservations can be made for this work, the reservations being taken up as firm orders are received. These requests from sales department may either take the form of a request to reserve a specific number of tons of productive capacity per week in a given section of the foundry, or a customer may send in an approximate schedule of requirements, subsequently covered by firm orders when his exact requirements become known.

The procedure to adopt to ensure that accurate delivery information is given when an enquiry is received from the sales department is as follows:—Looking at the capacity allocation chart (Fig. 9), it is seen that in total there is a capacity of 1,000 hrs. per week. It is appreciated, however, that customers X, Y and Z, between them, will call for 700 hrs. of this, so that there are only 300 hrs. available for miscellaneous work. Looking at the chart, it is seen that the first week in which there is any substantial capacity available is between weeks C.12 and C.13. The works, therefore, sends a promise to its customers, based on production commencing at about that date. Sales department may be able to say that they definitely expect that order to come in, and ask to reserve capacity. In this case, the management would put on the chart dotted lines, reserving the necessary capacity at the time.

Generally speaking, however, a jobbing foundry, accepting enquiries for business, does not expect to book orders to the extent of more than 30 per cent. of the total number of enquiries it handles. No action is therefore taken to reserve capacity until the firm order is received.

The Author has dealt, so far, with the planning of work up to the time that metal is poured into the mould. Many of steel foundryman's customers think that when a casting has been poured all the troubles are over, and that the casting can be put on to a lorry the following day. It is, however, a fact that the job of fettling steel castings in approximately the order in which they are cast constitutes a major problem. The Author has nowhere seen a layout that does the job really effectively, except in foundries engaged in the mass production of one type of casting. An attempt is being made to tackle the production control aspects of the problem in the Author's works, which it may be of interest to outline briefly.

The first essential is that one week's production from the foundry must be completely cleared from the first fettling operation before any new castings from the following are tipped. This may sound Utopian; it is, however, being done regularly, the only requirement being a good supply of skips to enable a fair stock

## Some Production Control Principles

of castings to be held between the foundry and fettling shop.

The first operation in the fettling shop is shot-blasting, after which, all fins, gates, and risers are removed, partly by chipping and partly by oxy-acetylene burning. At this stage the castings are readily identifiable, all adhering sand having been removed, and a 100 per cent. inspection and count is taken. To assist in this count, a fettling shop programme is prepared weekly, which is prepared by analysing the castings records for the previous week. Castings counted are then marked off against this programme so that any shortages become readily apparent. The inspection, along with the count, ensures that defective castings are thrown out at an early stage in fettling, thus eliminating unnecessary work on castings which would be thrown out at final inspection. Inspection notes are made out for castings scrapped or missing, so that replacement can, in the majority of cases, be put in hand while the pattern, off which replacements are required, is still in production. After this inspection point no check is taken until castings pass over the weighing machine for despatch. Between the checking point and despatch, castings are kept in skips and off the floor as much as possible, and steps are taken to ensure that each operator finishes one skipful of work before he starts on the next.

### Conclusion

The development of production control as a branch of engineering technique has been forced on the engineering industry on account of the vast amount of detailed information which is required in an organisation of any size in order to meet present-day standards of quality and service, combined with smooth working on a large volume of production. According to the product being manufactured, so the scheme of production control varies considerably in detail, but it does appear that, whatever the product, the same basic principles apply. An attempt has been made to frame this Paper on lines which will give the reader some ideas regarding the application of production control to the product on the manufacture of which he is engaged, using for the purpose of illustration the application of production control to steel foundry work.

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THE DIRECTORS OF Sheffield Steel Products, Limited, have given the formal three months' notice to redeem the £275,415 6 per cent. mortgage convertible debenture stock at 105 on November 21 next. The intention to redeem this stock was announced at the annual meeting on July 31.

THE NOMINAL CAPITAL of Bayliss Jones & Bayliss, Limited, iron and steel bar rollers, manufacturers of bolts, nuts and railway and tramway fastenings, etc., has been increased by 50 per cent. The authorised total has been raised from £400,000 to £600,000 by the creation of 200,000 £1 ordinary shares. The company is controlled by Guest, Keen & Nettlefolds, Limited.

## INFLUENCE OF TRACES OF IRON ON A LIGHT ALLOY

Miss Françoise Mahn, writing in C.R. Acad. Sc., 1944, 218, on the influence of traces of iron in the magnetic properties of magnesium—rich, magnesium-cerium alloys—has summarised her researches as follows.

Magnesium melted in the presence of iron carries at least 0.1 per cent. of Fe on cooling. This maximum content is considerably reduced by successive remeltings of the metal (decantation of the iron). The mixing of paramagnetic cerium with 1.27 per cent. of iron and magnesium gives for alloys (20 to 40 per cent. cerium), of which the very pronounced ferro-magnetism is transformed by a marked reduction in the coefficient of magnetisation as a function of the field. In these alloys, the iron, precipitated in a very fine state of division, slowly decants itself as with pure magnesium. The direct melting at 870 deg. C. of a magnesium-cerium alloy (cerium $<$ 40 per cent.) in the presence of a large excess of iron, does not allow the introduction of more than 0.1 per cent. of Fe.

The research undertaken permits of the assertion that the ferro-magnetism of magnesium-cerium alloys is integrally due to a precipitation by the magnesium either of fine iron or a ferro-magnetic alloy of an iron base; that iron crucibles can be used without any inconvenience for the practical compounding of these alloys by the melting together of their constituents, as the iron is but feebly soluble in magnesium-cerium, with cerium less than 40 per cent.

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## BRITTLENESS IN Al-Zn ALLOYS

Writing on the subject of the brittleness noted in aluminium-zinc and aluminium-zinc-magnesium alloys in C.R. Acad. Sc., 1944, 218, Mr. G. Chandron, Mr. J. Herengnel and Mr. P. Lacombe confine their attentions to the incidence of this factor in solid solutions during their hardening. This is to be observed in aluminium-zinc alloy during a prolonged period at room temperature in the absence of any exterior tension. The ageing in air (under a negative pressure) is brought about without any cracking, but if one carries out a tensile test on such an alloy, a very clear intercrystalline parting—similar in character to the fissures in alloys aged in air, takes place.

This observation shows that the intercrystalline lack of cohesion set up by the hardening is revealed either by the application of an external stress or by the intergranular corrosive action of oxygen or moisture. This same phenomenon of lack of cohesion is known to give pronounced brittleness to solid solutions of ternary Al-Mg-Zn alloys carrying high percentages of magnesium and zinc.

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RICHARDSONS, WESTGARTH & COMPANY, LIMITED, have under consideration a scheme for extending their works at Wallsend, in order to meet orders for certain classes of machinery.

# GRAVITY DIE CASTING

By A. R. PALMER

*Discussion on a Paper read before the Lancashire branch of the Institute of British Foundrymen, Mr. A. Hopwood in the chair. The Paper was printed in our last issue.*

MR. A. PHILLIPS (Manchester) referred to an item shown in the films. When the die was semi-mechanised, what was Mr. Palmer's opinion regarding the withdrawal and replacement of a top core, by means of counter-balanced hoist, composed of cable and pulleys? The operator by this means withdraws the top core, the core remaining stationary in the air, without the operator having to make a further movement or a secondary movement away from it. He had noticed this kind of thing in some of the gravity die-casting establishments he had visited, and it appeared to be an excellent system.

Another question was with regard to the characteristics, and the composition of the alloys used, with particular reference to the sample castings exhibited. Were the sample castings made in aluminium-silicon alloy L33, or were they made in alloy to Specification DTD424? Was there any main difference in making gravity die castings of thin sections, especially with regard to DTD424 alloy and L33 alloy.

### Die Erosion

The lecturer did not appear to experience much difficulty in regard to erosion of the die caused by the molten alloy, because he stated he used a close-grained cylinder iron. The point he (Mr. Phillips) was interested in with regard to gravity die casting was more in the nature of the brasses and aluminium bronzes. His firm had made experiments, and confirmed that acicular cast iron gives a much longer life; in fact, treble the life of the ordinary high-strength cast iron or, to use a misnomer, semi-steel. Was acicular iron used in aluminium dies?

A point which was difficult to understand with regard to some of the aluminium alloys was the sticking of core pins. Ordinary mild steel had been used by Mr. Palmer, but had he experienced much difficulty with any of his core pins with the metal binding on the core pin, or erosion of the core pin? There was a considerable difference between gravity dies and pressure dies as regards the life of core pins, and he would like to hear an expression of opinion on the point. It was said that oil-sand cores should be comparatively free from gas. What would Mr. Palmer use for jointing cores so that he might have a core comparatively free from gas?

### Alloy Behaviour

MR. PALMER said that he used the mechanism referred to for large top cores. For small top cores the core was levered and withdrawn with one hand, and placed on the die operating table. Larger cores were mechanised by means of a cable and balanced weight, so that the action was entirely a case of levering and pushing into the air. The castings shown in the films, and the exhibits, produced to the meeting, were, with one exception, produced in DTD424 alloy. The boost and mixture control casting was produced in L33 alloy.

The question had been raised as to whether there was much difficulty in running a casting in DTD424 compared with L33 alloy. The latter was, of course, much more fluid than DTD424, which was a sluggish metal, but there was very little difficulty experienced when producing similar castings in DTD424. He had stressed this point in the Paper.

The running of thin-section castings in DTD424 alloy depended very largely upon the dies being suitably prepared with the coating preparation and correct die temperatures, a smooth-finish coating being applied. As a contradiction, however, castings in L33 alloy could only be produced satisfactorily by what was termed a medium-coarse coating. There was the peculiarity with L33 that, although the metal was the most fluid of all the existing alloys, yet by applying and running with a smooth coating, surface blow marks appeared on the castings. It was peculiar that, although DTD424 alloy was sluggish as compared with the fluidity of L33 alloy, castings in DTD424 could be produced with almost a dead smooth coating, without blow marks as surface defects. There was no difficulty in producing castings in DTD424 to 0.1 in. thickness, but it was possible to produce castings in L33 alloy slightly thinner in section than in DTD424.

With regard to the point of erosion, or the metal sticking to core pins, that difficulty was experienced, but the preparation of the coating and the lubricating of the core pin made a great deal of difference. The coating was prepared for the core pin in the same way as the die; it was dipped afterwards in a graphite-and-water solution. In operation, the core pins were withdrawn, dipped in graphite-and-water solution, leaving a deposit of graphite for lubrication, thus preventing much of the sticking and overcoming erosion. Incidentally, the action of dipping the core pins chilled the pin, thereby hastening solidification of the particular boss surrounding the core pin.

Dealing with the use of mild steel for pins instead of special alloy steels, his experience was that special alloy steels would stand up longer in the die, but that they were much more difficult to replace. The steel was much more expensive as to machining time as compared with the ease with which mild-steel pins were replaced. The advantage of the length of life of a mild-steel pin greatly outweighed the use of special alloy steels. He had no experience of dies in acicular iron.

So far as brasses and bronzes were concerned, they suffered very severely from erosion. With regard to the gravity die casting of brass, difficulty was experienced through zinc oxidation and rapid filling up and erosion of the die cavities by such oxidation. He had been asked what material he used to overcome gassing, created by the jointing material for sand cores. First of all, he very much disliked any die castings having to use a sand core which had to be jointed.

## Gravity Die Casting

The cores exhibited were not jointed, but were produced solid. Whenever cores had to be jointed paste was used.

### Aluminium Powder Coatings

MR. PHILLIPS was interested in the use of aluminium powder for the coating preparation of the dies. Why had there not been any development of the use of aluminium powder as a base in the coating? Had Mr. Palmer any experience of using such a coating?

MR. PALMER replied he had not made any experiments with aluminium powder as a base for coating preparation, and the only remark that he could make was that aluminium powder was not a refractory, and in his opinion if it was used as a base for the coating, there would be a fusion between the coating and the casting.

MR. PHILLIPS could not speak with regard to gravity die castings, but with pressure die casting the aluminium powder base in the coating seemed to give a better finish and a clearer skin than some of the other coatings.

### Aluminium Dies

MR. PALMER said that in speaking of aluminium and aluminium powder being used as a coating, the construction of dies had developed to such an extent that dies were being made of aluminium alloy. He had not seen the process carried out, or experimented with it, but it was being done. The advantage was fairly obvious. The dies were more easily machineable, but he did not know that the process was adopted in the case of complicated castings.

### Melting Conditions

A MEMBER, speaking with reference to the melting of aluminium, asked whether it was first melted in a melting furnace, and then transferred to the second furnace, where some powder was added, and stirred into the melt. He would like to know what the powder was called. Had the pyrometer a sheath, or was it a bare couple. Of course, the use of a sheathed couple was slow in operation, but the bare couple was much quicker. Another point for consideration was how to deal with the over-heating of aluminium, if it occurred, and what was the temperature at which to cast.

MR. PALMER said that with regard to the transfer of metal to the maintaining furnace, in the first place, the metal was melted in the melting bank, under strict temperature control. The metal was taken in the melting furnace to a temperature approximately 10 to 20 deg. higher than was necessary for the predetermined temperature required for the maintaining furnaces, which allowed for the drop in temperature taking place from the melting bank to the maintaining furnace. The casting temperatures were dependent entirely upon the alloy being used. L33 was extremely fluid, but DTD424 alloy was not only sluggish in flow, but was sluggish in feed and required a higher temperature. Again, the complexity of the casting was taken into consideration in predetermining the temperature. Then in regard to thick or thin castings, the complexity so far as the mass was concerned should be taken into consideration. The temperatures ranged from approximately 680 deg. C. for L33 alloy, to 740 deg. C. for DTD424 alloy. He had found that DTD424 could be taken to 760 deg. C. in certain instances, and radiographs had shown no sign of porosity. As a matter of fact, there had been much better feeding taking place at that temperature than at a lower temperature, particularly so where it had been necessary to delay solidification of the thin sections, in order adequately to feed the thick sections.

The thermocouple of the pyrometer used was sheathed, but approximately ¼ to ½ in. of the couple was bare at the end. The over-heating of the metal occasioned disastrous results in die work just as in sand work. Over-heating of the metal induced gas, and a large grained structure, with its mechanical weaknesses. Liberties with regard to metal temperatures could not be taken as in the case of sand castings, though it must be understood that liberties should not be taken in sand casting if it was desired to produce a perfectly sound casting.

### Sheet-metal Facings

MR. BEDFORD said he had seen a sheet-metal template or stencil, used to obviate later cleaning of die faces. He thought this was a practical proposition.

MR. PALMER agreed it was quite a good idea. Generally speaking, the die faces were not protected, but were cleaned later. In die preparation, however, the taking off of the coating in the die cavities where it is necessary to remove coating for a chilling action, as shown in the film, was not normally carried out. Sections of the casting were placed in the cavities and the coating preparation sprayed around it, leaving the cavity faces where chilling is required free from coating.

### The Derville Process

MR. W. HOWARTH (Keighley) asked if the Derville process of running was used in gravity die casting. Could Mr. Palmer say why, by this method, inclusion of oxide was eliminated, especially in regard to brass and aluminium bronzes?

MR. PALMER said that the tilting of the mould, or the Derville process, had been practised by him for many years, and was being used in the foundry at the present time. There was an illustration showing the mould being swung as it was turned. The mould was carried on two pedestals, and was tilted at an inclined plane. The process was used in connection with large flat-bottomed castings, the metal entering the runner when the die was tilted, filling the cavity at a level, while it was on the angle, the pour being maintained while the die was being brought back to the horizontal position. At no time must the stream of molten metal be broken. There must be a complete relationship between bringing the die back to the horizontal position and the pouring of the molten metal. By this method the air is being forced from the cavity in front of the path of the stream of molten metal.

MR. HOWARTH inquired whether a statement could

be made with regard to the results obtained with some of the castings. He had applied the process to sand castings, and it was found that the castings would withstand air pressure on pressure test. A much finer casting was obtained by what was called tilting.

MR. PALMER, agreeing, said all the castings exhibited with the exception of one casting with six brass inserts, were castings requiring pressure testing. The carburettor body shown had withstood 120 lbs. air-pressure test, and the boost and mixture control body casting, 80 lbs. air-pressure test. These castings were, however, cast in the horizontal position. He had not applied the Derville process in particular to castings requiring pressure testing, but only where there were large flat areas to cast. By the Derville process there was undoubtedly a smoother flow and the pour was much more controlled by this means overcoming turbulence, and thereby less tendency to porosity by the inclusion of dross.

MR. PHILLIPS said that a good illustration was when casting aluminium in slabs for rolling mills. The slab billet must always be cast in a particular way, otherwise there would be a flaw in the metal, which was shown more clearly when the metal was rolled out. In order to get a billet absolutely free from dross or anything entrapped, the tilting method was adopted as suggested by Mr. Palmer. If the pouring was done in any other way, a thin sheet could not be obtained.

MR. A. HOPWOOD (Liverpool) was interested in the clearance between the mild-steel core pins and the corresponding metal in the die. The die operating at a temperature of approximately 300 deg. C., and produced of cast iron, and the core pins produced in mild steel, and being chilled in each successive operation, how much clearance was allowed still to effect a seal at the casting surface?

MR. PALMER replied that in gravity casting the die cores and loose parts were not close fits, but an easy-running fit. Even where a part of the die was taken out for chilling purposes, an easy-running fit was made.

MR. HOPWOOD asked how much taper was allowed on mild-steel cores for withdrawal purposes.

MR. PALMER said he liked to have as much taper as possible. He liked to allow from 3 to 5 deg., but more often than not it was necessary to allow only ½ deg. It entirely depended upon the length of the hole to be cast.

MR. JACKSON assumed that the six brass inserts shown in the sample casting exhibited and in the film, were to be bored at some later stage, in order to act as bearings.

MR. PALMER replied that it was so.

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Following the presentation of the Paper, two ciné films depicting gravity die-casting methods were exhibited.

### Vote of Thanks

MR. A. PHILLIPS (Manchester) proposed that a hearty vote of thanks be accorded to Mr. Palmer for his extremely interesting and instructive Paper, and also for the film display in connection with it. Papers on die casting had been singularly scarce in the past, not only in the Lancashire branch but throughout the country. He recalled the occasion of an international conference when American foundrymen were astonished at some of the gravity die castings made in this country. Mr. Palmer's Paper had dealt merely with aluminium gravity die castings, but the system applied also to brasses and bronzes.

The American visitors took one of the gravity die castings back with them, and subsequently asked a firm in this country if they would make them a die as they had not been able to make one successfully themselves. Looking at the screen illustrations it seemed to be an easy thing to do, but probably Mr. Palmer's staff had had several headaches before they attained their present standard of success. Within a few months of the visit of the Americans to this country the technical Press of the U.S.A. published photographs and pictures of die design, etc., which was a clear indication of the interest they took in such work once they undertook it. In this country we had not publicised the practice of making die castings as much as was desirable, and when foundrymen wished to acquire information they invariably turned to the American press for it.

MR. J. JACKSON (Accrington), seconding the vote of thanks, said Lancashire foundrymen appreciated practical Papers. It was not so very many years ago since Mr. Palmer came into the Northern area, and asked him to make him a few castings for the preparation of dies. Mr. Palmer then began in a small way, but he had now established a magnificent works, and was heartily to be congratulated upon having succeeded in doing so.

In responding, MR. PALMER said he had devoted much time and study to the preparation of the Paper, and was also heartily grateful for all the assistance his staff had given him in connection with it, as well as to Mr. Taylor for having prepared the films. It was not easy to convey an adequate impression of the worries and perplexities involved in gravity die casting in a single Paper, and really the only completely satisfactory way of dealing with such a subject was to split it into many parts and deal with each portion as a separate lecture. If he had succeeded in conveying some idea of the correct way to undertake gravity die casting he would be amply repaid for all the trouble he had taken in the matter.

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## COMMITTEE OF ENQUIRY

We are authoritatively informed that, contrary to the information given last Monday in "The Times," no committee has yet been set up to investigate working conditions within the foundry industry. The truth is that one is in process of formation.

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MR. W. E. PRYTHERCH, M.Sc., has relinquished his position as technical director of High Duty Alloys, Limited. He intends to act as an independent research consultant, and in particular will act in that capacity for the group of companies which Col. W. C. Devereux is at present forming.

## AMERICAN FOUNDRYMEN'S ASSOCIATION

The following national officers and directors of the American Foundrymen's Association were elected at a 1945 Administrative Congress held in July, at Chicago: *President,* Mr. F. J. Walls (International Nickel Company, Detroit); *vice-president,* Mr. S. V. Wood (Minneapolis Electric Steel Castings Company, Minneapolis); *directors:* Mr. George K. Dreher (Ampco Metals, Inc., Milwaukee), Mr. E. W. Horlebein (Gibson & Kirk Company, Baltimore, Md.), Mr. H. H. Judson (Goulds Pumps, Inc., Seneca Falls, N.Y.), Mr. James H. Smith (Accessories Group, General Motors Corporation, Detroit), and Mr. F. M. Wittlinger (Texas Electric Steel Casting Company, Houston, Texas). In addition, the retiring president, Mr. R. J. Teetor (Cadillac Malleable Iron Company, Cadillac, Mich.), was elected a director to serve one year.

**Foundry Leaders Honoured**

Two gold medals and three honorary life memberships in the association were presented at the meeting. The John A. Penton Gold Medal was presented to Mr. C. E. Sims (Battelle Memorial Institute, Columbus, Ohio) for his contributions to the steel-casting industry. The Joseph S. Seaman Gold Medal was presented to the secretary, Mr. Robert E. Kennedy, for his long and meritorious service in organising and guiding the technical activities of the association on behalf of the entire industry.

Honorary life membership was presented, *in absentia,* to Rear Admiral Van Keuren, U.S.N., Naval Research Laboratory, Washington, D.C., in recognition of his work on behalf of the castings industry; to Mr. M. J. Gregory, retired, formerly of the Caterpillar Tractor Company, Peoria, Ill., for his contributions to the association and the foundry industry; and to the retiring president, Mr. R. J. Teetor.

**Annual Business Meeting**

In lieu of the association's annual convention, voluntarily cancelled in accordance with the Government's request, the annual business meeting of the association was held as a dinner meeting on July 18. Newly elected national officers and directors were announced, and a digest of the 1945 Foundation Lecture on the "Solidification of Metals" was presented. In the absence of the Foundation Lecturer, Dr. H. A. Schwartz (National Malleable & Steel Castings Company, Cleveland), the digest was presented by Mr. F. G. Sefing (International Nickel Company, New York).

Winners in the national apprentice contests in moulding and patternmaking, sponsored by the association, were announced at the business meeting. The guest speaker was Mr. Max Kuniansky (Lynchburg Foundry Company, Lynchburg, Va.), who discussed "Castings and Post-war Industry," urging foundry management to play a more active part in solving its man-power problems by presenting foundry work as a field of unlimited opportunities for the future.

On July 18 and 19, the national officers and directors of the association held their annual board meetings to consider ways and means of serving the growing requirements of a constantly increasing membership. It was pointed out that the present membership of nearly 8,000 is a record.

**Mr. Kennedy's Service Recognised**

In recognition of his long and outstanding service with the association as technical secretary and secretary, Mr. Robert E. Kennedy was designated secretary emeritus by the board. Mr. Kennedy has been active with the association since 1921 and his organisation and guidance of technical committee work and chapter activities has played a large part in developing improved practices and processes throughout the castings industry. As secretary emeritus, Mr. Kennedy will continue to play an active part in A.F.A. councils.

Mr. Wm. W. Maloney, formerly business manager of the association, was elected secretary and chief administrative officer. Mr. N. F. Hindle was re-elected director of the technical development programme, Mr. C. E. Hoyt was re-elected treasurer, and Miss Jennie Reininga re-elected assistant treasurer.

## INSTITUTE OF METALS

The annual autumn meeting of the Institute of Metals will be held at the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, on September 12. The sessions will commence at 10 a.m. and 2.15 p.m. A buffet lunch (price 4s.) will be provided in the Marble Hall of the Institution of Mechanical Engineers for those members who make formal application.

The following Papers are to be presented:—"An Electron-diffraction Study of the Atmospheric Oxidation of Aluminium, Magnesium and Aluminium-magnesium Alloys," by L. de Brouckère; "The Application of the Vacuum-fusion Method of the Determination of the Oxygen, Hydrogen and Nitrogen Contents of Non-ferrous Metals, Alloys and Powders," by H. A. Sloman; "Some Effects of Oxygen in Silver and Silver Alloys," by J. C. Chaston; "Microporosity in Magnesium Alloy Castings," by W. A. Baker; and "The Properties of Some Magnesium-aluminium-zinc Casting Alloys and the Incidence of Microporosity," by F. A. Fox.

## SOUTHERN IRISH IRON AND STEEL IMPORTS

For the first six months of this year Southern Ireland imported iron and steel and manufactures to the value of £641,167, as compared with £495,263 for the corresponding half-year in 1944. The June figure was £103,298, against £43,298. Some of the imports for the half-yearly periods are noted below:—Pig-iron, £9,433 (£9,798); steel, £36,618 (£8,017); iron and steel manufactures, fabricated, £5,275 (£714); ditto, not fabricated, £30,578 (£4,309); railway material, £17,134 (£9,034); cast iron, £14,920 (£6,172); cast iron and manufactures, £20,936 (£15,918); hollow-ware, £24,069 (£16,059); tanks, cisterns, etc., £3,338 (£655).

Imports of non-ferrous ores, metals and manufactures for the half-year totalled £168,493, against £73,942, the June figure being £37,283, against £11,687.

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***clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify STANTON MACHINE CAST PIG IRON***

SPECIFICATION

| | |
|---|---|
| WEIGHT | 80-90 lbs. |
| Length | 22 inches |
| Width | 8½ inches |
| Thickness | 3¾ inches |

(at notch 2½ inches).

***Made in our well-known***

**STANTON, HOLWELL & RIXONS BRANDS**

**THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM**

## NEWS IN BRIEF

DAVID BROWN & SONS (HUDDERSFIELD), LIMITED, have opened an area office at 109, Pilgrim Street, Newcastle-upon-Tyne.

THE AMERICAN GENERAL ELECTRIC COMPANY, of Schenectady, is planning the erection of a new research laboratory, to cost about £2,000,000.

CRIBBEN & SEXTON COMPANY recently despatched by air from their Chicago factory a consignment of gas ranges weighing 8 tons to Los Angeles for urgent building requirements.

AN ENGINEERING EXHIBITION, organised by the Bristol Engineering Manufacturers' Association, is to be held at the Victoria Rooms, Bristol, from September 7 to September 15, inclusive. There are nearly 50 exhibitors.

ASSOCIATED MANGANESE MINES OF SOUTH AFRICA, LIMITED, have posted letters of right for the issue at 6s. each of 408,878 5s. ordinary shares in the proportion of three for every 10 held on July 20 last. Fractions will be ignored. Lists will close on September 5.

AS FROM SEPTEMBER 3, the address of the Joint Iron Council, the Council of Ironfoundry Associations, and the Council of Iron Producers will be Derbyshire House, Belgrove Street, King's Cross, London, W.C.1. All correspondence should be addressed to the Director, Mr. Arthur R. Knowles, O.B.E.

MANUFACTURERS WISHING to undertake preparatory work for post-war trade, and who have hitherto had to make individual application to the Board of Trade, need no longer obtain this specific authority. It will still be necessary, however, for firms to obtain licences for raw materials where this is subject to control.

AT THE ANNUAL MEETING of W. G. Allen & Sons (Tipton), Limited, Mr. Arthur Colegate (chairman) said that the Government should make clear at the earliest possible moment what the future of private enterprise was to be. Everyone must be careful to give the new Government a fair deal, but it was equally important that the Government itself should give a fair deal to those upon whom would rest the main burden of turning the energies of the nation once more into productive channels.

SIR LEONARD BROWETT has been appointed director of the National Union of Manufacturers in succession to Sir Charles Hipwood, who has retired in consequence of indifferent health. Sir Leonard Browett has had a long and distinguished career in branches of the Civil Service closely connected with industry. In 1937 he was appointed Permanent Secretary to the Ministry of Transport, where he served through the strenuous early days of the war until 1941. In 1942 he went to Washington, D.C., as Secretary-General of the British Ministry of Supply Mission and British Army Staff, which post he held until he returned to this country in 1944.

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CORRECTION.—In last week's leading article, a typographical error occurred. The town Quayaquil was printed instead of Barranquilla.

## CONSUMPTION OF NON-FERROUS METALS

In June last the Ministry of Supply issued detailed figures of the consumption in the United Kingdom during the war years of the metals within the scope of the Non-ferrous Metals Control. Figures for the second quarter of 1945 are now available, and are given below, while, for comparison, the results for 1944 and the first quarter of 1945 are repeated.

*Total consumption of Virgin metal (tons).*

| | Year 1944. | First quarter, 1945. | Second quarter, 1945. |
|---|---|---|---|
| Copper .... .... .... | 348,139 | 81,103 | 72,378 |
| Zinc .... .... .... | 184,241 | 45,411 | 43,109 |
| Lead .... .... .... | 205,385 | 51,517 | 55,265 |
| Tin .... .... .... | 18,435 | 3,949 | 4,037 |
| Nickel .... .... .... | 12,420 | 2,431 | 2,214 |
| Cadmium .... .... | 377 | 114 | 121 |
| Antimony .... .... | 4,772 | 1,265 | 1,348 |
| Cobalt .... .... .... | 787 | 195 | 168 |
| Manganese metal .... | 861 | 144 | 134 |

It will be seen that over the first half of 1945 consumption in most metals (especially copper and nickel) was below the 1944 level, reflecting the reduced demand for munitions.

## MANUFACTURE OF INTERNAL COMBUSTION ENGINES

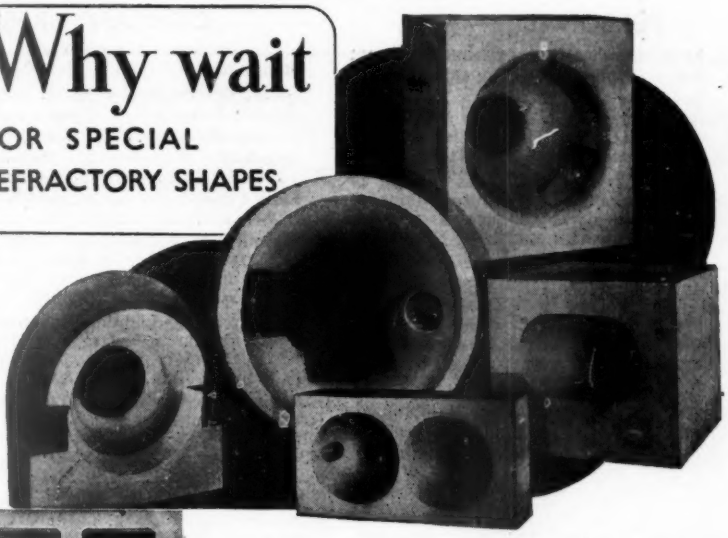
A certain degree of relaxation of the control of the internal combustion engine producing industry has now become possible. In general, makers are now free to accept and execute all orders—including civilian orders for home and export—without prior reference to the Ministry of Supply, as has been necessary in the past. The only exceptions are where capacity to produce some few types of internal combustion engines and spares for the fighting services is hardly sufficient to meet the prevailing demand.

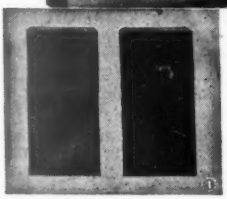
## STEEL FEDERATION PRESIDENT

The death of Sir Allan Macdiarmid having left the position of president of the British Iron and Steel Federation vacant, this position will be taken up by Mr. Ellis Hunter, president-elect of the Federation. Mr. Hunter, in virtue of his office, would have become president at the beginning of 1946. Mr. Hunter has for some time past been closely concerned with the industry's plans for development and expansion. A Yorkshireman, Mr. Hunter is deputy chairman and managing director of Dorman, Long & Company, Limited, and has a long experience of the iron and steel industry.

# Why wait

FOR SPECIAL
REFRACTORY SHAPES





**NO SHRINKAGE.** Illustration (1) shows two blocks cast in moulds and dried at atmospheric temperature. One was fired to 1500° C for four hours. Specimens are the same size.

**STRENGTH.** Illustration (2) shows two test pieces cast in moulds, dried at atmospheric temperature and one heated to 1000° C. Tensile strength —*Unfired*, 550 lbs. per sq. in. *Fired*, 1312 lbs. per sq. in.

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ACID - PROOF MATERIALS
CEMENTS . PLASTICS
INSULATION . SILICA BRICKS
SILLIMANITE . SANDS

## Make them quickly and economically

## with DURAX No. 2
## REFRACTORY CONCRETE

IN CASES of emergency, special shapes and replacements may be made quickly with Durax No. 2 Refractory Concrete. Mixed similarly to ordinary building concrete, Durax is poured into position, dries quickly and sets to a remarkable degree of hardness. There is no permanent volume change and tests have shown no signs of fusion below 1580° C—there is no tendency to crack or spall. Durax No. 2 is used for protection of header tubes and drums in water tube boilers, access door and lid linings, flame baffles, burner blocks, furnace and coke oven door linings, complete monolithic linings, small monolithic arches and all types of special shapes.

## General Refractories
LIMITED

GENEFAX HOUSE SHEFFIELD, 10, ENGLAND.
TELEGRAMS: "GENEFAX. SHEFFIELD"

33

## PERSONAL

MR. W. M. MCKENZIE has been appointed assistant secretary of Bruce Peebles & Company, Limited, Edinburgh.

LT.-COL. PARR-DUDLEY has been appointed manager of the London office of the Brush Electrical Engineering Company, Limited, and subsidiaries.

MR. R. F. HUDSON has relinquished his position as chief metallurgist to the Phosphor Bronze Company, Limited, Birmingham, on his appointment as foundry manager with British Engines, Limited, of Newcastle-upon-Tyne.

MR. D. MCMILLAN and MR. J. R. FLEMING have been appointed to the board of Qualcast, Limited. Mr. McMillan is managing director of the company's subsidiary at Manchester, Follows & Bate, and Mr. Fleming is general works manager of the Qualcast factories.

MR. R. COOK, M.Sc.(Eng.), has been appointed marine engineer to the British Shipbuilding Research Association. Until recently he was deputy assistant director, D.S.R., Ministry of Supply, to whom he was on loan from the Fuel Research Station, D.S.I.R., where he was senior scientific officer.

MR. W. SCOTT, J.P., has been appointed managing director of the Jarvis Industries Group (Sir W. G. Armstrong Whitworth & Company (Ironfounders), Limited, Armstrong Whitworth & Company (Pneumatic Tools), Limited, and Jarrow Metal Industries, Limited), following the death of MAJOR T. G. BIRD.

DR. W. T. GRIFFITHS has been appointed chairman of the Mond Nickel Company, Limited, and of its subsidiary companies, in succession to the late Mr. D. Owen Evans, M.P. Dr. Griffiths was for many years head of the research and development department of the company. His appointment is in accordance with the tendency to promote technical staffs to the highest executive positions.

DR. A. H. MIDDLETON retired at the end of July from his executive position after 40 years as head of the coke and brickworks department of the Consett Iron Company, Limited. Dr. Middleton has had an outstanding career in the carbonising and refractories industries. He was responsible for the introduction of the first all-silica coke-oven battery to this country, and in addition to his active and successful work on the practical side, he has taken a keen interest in academic work and research. He is retaining his interest in industry and will continue to act for his company in a consultative capacity. Dr. Middleton has been succeeded by MR. G. M. NAVE, for the past three years Dr. Middleton's chief assistant.

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THE NAME OF Mr. William Bacon Richards, director and general manager of Keith Blackman, Limited, who died recently, was inadvertently printed in our August 16 issue as Mr. William Bacon.

## COMPANY RESULTS

*(Figures for previous year in brackets.)*

**Range Boilers**—Interim dividend of 5% (same).

**Head, Wrightson**—Net profit, £26,148 (£21,533).

**Scottish Machine Tool**—Net profit, £50,896 (£92,429); dividend of 8% (same).

**Brightside Foundry & Engineering Company**—Dividend of 35% (same) and a bonus of 5% (nil).

**Steel Corporation of Bengal**—Net profit, after tax, for 1944, £247,026 (£228,075); dividend of 8¼% (same).

**Larmuth & Bulmer**—Net profit for the year to March 31 last, after taxation, £4,870 (£5,357); final dividend on the ordinary shares of 7½%, making 10% (same); forward, £6,099 (£5,363).

**Engineering & Lighting Equipment**—Net profit for the year to March 31 last, after depreciation and tax, £21,357 (£21,454); final dividend of 5%, making 8% (10%); forward, £1,552 (£1,896).

**Richardsons Westgarth**—Trading profit to March 31 last, after tax and deferred repairs, £121,235 (£118,009); other income, £3,364 (£4,472); bank interest, £3,600 (£3;136); depreciation, £55,719 (£46,586); dividend of 8% (same); forward, £79,348 (£58,933).

**W. H. Dorman**—Net profit for the year to March 31, after charging working and administration expenses, interest, maintenance and depreciation, pension scheme, etc., £82,723 (£123,637); to general reserve, £5,000 (£5,516); taxation, £68,000 (£109,000); dividend on the ordinary shares of 16¼% net (same); forward, £7,616 (£7,226).

**Aeroplane & Motor Aluminium Castings**—Trading profit for 1942-43, after E.P.T., £36,073; depreciation, £13,934; war damage, £596; net profit, £21,193; tax, £12,500; dividend of 10%; forward, £19,885 (£16,192). Trading profit for 1943-44, including £5,000 E.P.T. repayable, £35,359; depreciation, £13,119; war damage, £562; net profit, £21,328; tax, £13,000; dividend of 5%; forward, £25,713 (£19,885).

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## OBITUARY

MR. HARRY BEGG, Provost of Falkirk for six years up to 1943, and ex-president of the Iron Fitters' Association, has died suddenly.

MR. J. A. E. WELLS, director and foundry manager of Edgar Allen & Company, Limited, Imperial Steel Works, Sheffield, has died at the age of 59, following an operation. Mr. Wells, who came from a family well known in the foundry industry, was a member of the Institute of British Foundrymen and of the Iron and Steel Institute. He was educated at Wesley College and the University of Sheffield.

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DR. W. J. REES, O.B.E., has been elected president of the British Ceramic Society. He has been head of the Refractories Department of Sheffield University since 1917, and his election to the presidency of the British Ceramic Society takes place on the eve of his retirement from the department.

# WHY ST. LAWRENCE
TRADE-MARK

# SILICOMANGANESE

## *Gives Cleaner Steel in Shorter Time*

"ST. LAWRENCE" Silicomanganese cleanses steel in a shorter time than silicon and manganese used separately. "St. Lawrence" Silicomanganese dissolves rapidly in the molten bath and unites with oxygen and other impurities to form a fluid, low-melting, manganese silicate slag that quickly rises to the surface. Thus impurities are quickly removed from the steel, leaving it clean and ready for tapping in 10 to 15 minutes.

"St. Lawrence" Silicomanganese has a very low carbon content. Thus the carbon in the bath need not be reduced as much as would ordinarily be necessary.

This combination of rapid cleansing and low carbon content makes possible close control of final analysis. Cleaner, more uniform steel results.

Further information about silicomanganese and the other ferro-alloys and alloying metals listed at the right will be gladly sent on request.

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StL
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*Chromium*
Low-Carbon Ferrochrome
High-Carbon Ferrochrome

*Manganese*
Standard Ferromanganese
Low-Carbon Ferromanganese
Medium-Carbon Ferromanganese
Silico-Spiegel

*Silicon*
Ferrosilicon
(All grades)
Silicon Metal

*Silicomanganese*

*Calcium*
Calcium-Silicon
Calcium-Manganese-Silicon

*Ferro-Alloy Briquets*
Silicon Briquets
Silicomanganese Briquets
Chromium Briquets

## Raw Material Markets

### IRON AND STEEL

Nowhere are there any great accumulations of pig-iron and some establishments are working on slender stocks. The blast furnaces are steadily maintained on full production and it looks as though expansion of output in the autumn will become a question of ways and means. Holiday interruptions in the operations of the steel mills have had the effect of increasing the reserves of basic pig-iron, but there is no surplus of foundry iron and any interruption of deliveries such as occurred in the recent holiday periods causes immediate anxiety and inconvenience.

There is still wide scope for improvement in the engineering foundries, which, however, may not be long delayed. They are in the process of turning over from munitions-making to peacetime production. In the meantime, no difficulties are experienced in obtaining adequate tonnages of refined, low-phosphorus, and hematite pig-irons, although it cannot yet be said that the last named is in really plentiful supply.

The scrap situation is now fairly easy, but the foundries are still willing buyers of all good quality material. Coke supplies are reasonably free at the moment and foundries are taking the opportunity of putting down stocks for the winter, when transport may be more difficult.

The position in regard to semi-finished steel is still undeniably tight, so much so that for defective material as well as for primes there is an avid demand. Consumption of sheet bars has probably reached its highest peak, but the requirements of the sheet mills are more adequately covered than are those of the mills engaged on small bars, light sections, etc. There is a rising note of urgency in the inquiries for billets, and the arrival of supplies from the Dominions, which is promised in the autumn, is eagerly awaited. It has been officially disclosed that imports of iron and steel, chiefly in the form of steel semis, totalled approximately 1¼ million tons last year and rather more than 2¼ million tons in 1943. This year the shrinkage in imports has been accelerated and fully accounts for the existing shortage of re-rolling material.

Observance of holidays has involved stoppages of the steel mills this month for varying periods. The end of these interruptions, however, is now in sight and producers will resume with substantial rolling programmes in hand and the prospect of still busier times ahead. Big tonnages of material are on order for the shipyards, railways, collieries and the locomotive and wagon shops, while the sheet mills cannot keep pace with the flow of orders for light sheets. Business in heavy joists and channels is not so brisk, but in this department there has been some improvement through the issue of export orders, which are expected steadily to increase in the coming weeks.

### NON-FERROUS METALS

There has been no outstanding change in the conditions governing the non-ferrous metals markets. The licensing system remains in force, but the restrictions on the purchase and use of metal are now very loosely applied. There are expectations of securing more tin now that the Japanese are being cleared out of Malaya and the Dutch East Indies, but obviously it will be some months before the ending of the war in the Pacific is reflected on the tin market here. Copper, lead, zinc and the light metals are fairly freely available.

With the ending of Lend-Lease, the need to expand our export trade has become more urgent. Manufacturers of metal-bearing articles can greatly assist in this direction and presumably will receive every encouragement from the Government. There is also the pent-up demand in the home markets to be met, and all told the non-ferrous metal trade should be in for an active time. At the moment, the lack of sufficient labour is holding up developments.

### NEW PATENTS

*The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.*

570,054 HIGH DUTY ALLOYS, LIMITED, and WHITBY, L. Forming protective surface coatings on metals.

570,096 WHITTAKER, E. H. Foundry plants.

570,113 INCANDESCENT HEAT COMPANY, LIMITED, HANNING, J. J., and HOWARD, J. R. Refractory members especially applicable to furnace hearths, dampers, and the like.

570,166 GROOM, E. J. Process for the recovery of light-alloy scrap.

570,168 CLIMAX MOLYBDENUM COMPANY. Production of molybdenum containing ferrous alloys.

570,287 DU PONT DE NEMOURS & COMPANY, E. I. and GRAY, A. G. Electro-deposition of lead.

570,289 MILIK, R. Chills for metallurgical furnaces.

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